strong H-Bonding

(**) Dipole-Dipole Interaction (**) Strength of Dipole $\propto \Delta EN$

(**) $E_R \Rightarrow$ 8 to 43 KJ/mole (**) F|O|N—H ⋯ F|O|N—

$\delta-$ $\delta+$ ⋯ $\delta-$ → H-Bonding

eg-(1) NH_3 in H_2O

→ Intermolecular H-Bonding → H-Bonding b/w two molecules (Same or Different)

(#) Benzene ⇒ C_6H_6

(#) Phenol C_6H_5OH

(#) ortho-nitro phenol

(#) para-Nitro Phenol

Priority of OH > NO_2

More volatile liq → Low B.P → easily vaporises

eg-(2) ortho-Nitrophenol is steam-volatile while p-nitrophenol is not steam-volatile. Why?

Sol":- o-Nitro phenol

→ Intramolecular H-Bonding

Possible only if 5/6 membered Chelation or Ring or Cyclization is formed by H-Bond

Molecules of o-Nitrophenol are connected by very weak interaction (Van der Waal force)

So, BP of o-Nitrophenol is very less and it is Volatile in Nature.

p-Nitrophenol

Inter H-Bond (very strong compared to Van der Waal force)

So, BP of p-Nitrophenol > o-Nitrophenol.

Ice → Solid H_2O

No of H-Bonds per H_2O = 4

(Cage) or void or Interstitial space → Vacant space

Due to these voids, Less No. of H_2O molecules Can be fit into a given volume compared to H_2O liq. So density of ice < $H_2O(l)$

(**) In Group 16 Hydrides

only H_2O exist as liq at room temp

While H_2S, H_2Se, H_2Te exist as gases at Room temp.

(#) 0°C H_2O ice (d_1) → H-Bond Breaking, 4 molecules are coming closer to each other, density ↑ → 4°C $H_2O(l)$ (d_2) → T ↑ Molecules move away → 10°C $H_2O(l)$ (d_3)

$d_2 > d_3 > d_1$

max density state

$d(H_2O \text{ at } 4°C) = 1$ g/ml

(#) HF ⇒ Exist in liq form at room temp due to Inter H-Bonding and HF(l) have zig-zag like pattern. (HF(s))

HCl, HBr, HI → Exist as gases at Room Temp.

(**) HF(g) → found to exist as $(HF)_6$ and $(HF)_2$, Monomer (HF)

(**) (#) $KF_{(s)} + HF_{(l)} \rightarrow KHF_2$ ⇒ Acid Salt

H-Bond

$KHCl_2$ ✗ $KHBr_2$ ✗ KHI_2 ✗

HCl, HBr, HI → Cannot form Acid Salt.

(#) B.P ∝ Molecular mass & Size

B.P will be abnormally high for small size molecules if H-Bonding is present.

BiH_3, SbH_3, AsH_3, PH_3, NH_3 — NH_3 has H-Bonding

B.P

H_2O, H_2Te, H_2Se, H_2S

B.P

HF, HI, HBr, HCl

B.P

B.P → $H_2O > HF > NH_3$

M.P → $H_2O > NH_3 > HF$